BASE MAP ADAPTED FROM U.S. GEOLOGICAL SURVEY NATIONAL MAP, 2013: TOPOGRAPHIC MAPS OF THE ALEXANDRIA, VA-DC-MD AND ANNANDALE, VA 7.5-MINUTE QUADRANGLES, NAD 1983

MAP LOCATION

SCALE 1:12,000

1 .5 0 KILOMETERS 1 2

1000 0 METERS 1000 2000

1 .5 0 1

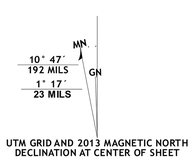
MILES

1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

FEET

CONTOUR INTERVAL 10 FEET

NORTH AMERICAN VERTICAL DATUM OF 1988



UTM GRID AND 2013 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

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DESCRIPTION OF THE MAP

The Potomac Formation constitutes the base of the Coastal Plain in the mid-Atlantic region, and extends from southern Virginia to northern New Jersey. The unit forms an eastward-thickening wedge of sediment, beginning at its feather edge in the western part of the map area and rapidly thickening to as much as 400 feet beneath the Old Town waterfront. Microfossil evidence indicates the part of the formation in the map area is between 113 and 131 million years old (Hueber, 1982).

The Potomac Formation crops out extensively in ravines, hillsides, and road cuts in the highlands west of Old Town, and is present in the subsurface everywhere except in the far west where it has been removed by erosion. At many places in the uplands, the Potomac Formation is concealed beneath a veneer of younger river terraces and other surficial deposits of Tertiary and Pleistocene age (see plate 5); beneath Old Town and Del Ray, it is covered by thick late Pleistocene-Recent alluvial deposits of the Potomac River. This map shows the geology of the Potomac Formation continuously throughout the city—as if the younger deposits that conceal it were stripped off. This depiction of the Potomac subcrop was constructed using a combination of subsurface data from wells and geotechnical borings, along with projections from surface outcrops.

The entire formation in Alexandria was deposited by a large river system, which consisted of a variety of freshwater depositional environments that varied in space and time. These included large channel systems, point bars, floodplains, backswamps, and oxbow lakes, among others. No definitive marine, tidal, deltaic, or estuarine deposits are currently recognized in the city. The entire formation has been tectonically tilted to the east-southeast by more than 100 feet per mile in the lowermost sections (the gradient of the bedrock surface), and by about 65 feet per mile in the upper parts of the formation. Much of the tilting is inferred to be related to the west-side-up Neogene compressional tectonics recognized along this part of the fall zone (Fleming and Drake, 1998; McCartan, 1989; Mixon and Newell, 1977).

On this map, the Potomac Formation is divided into several informal local members, or sedimentary facies, based on a combination of gross lithologic and textural characteristics (figure 1), clay mineralogy (figure 2), sedimentary structures, and stratigraphic position. Due to sparse data in some areas, some units (or parts thereof) and their relations to adjacent units are poorly known. The map also shows the thickness of the formation via 100-foot contours known as isopachs. The contours were generated by comparing the known or inferred top of the formation to the topography of the underlying bedrock surface (plate 3), which also represents the altitude of the base of the formation.

For this map, only the Potomac Formation within the City of Alexandria and selected portions of adjacent jurisdictions was mapped in detail. Elsewhere, the geology was adapted with mostly minor modifications from Drake and Froelich (1986) and Drake and others (1979). A more complete account of the Potomac Formation, this map, and how it was compiled can be found in the expanded explanation of plate 4.

REFERENCES AND DATA SOURCES

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Froelich, A.J., 1985, Folio of geologic and hydrologic maps for land-use planning in the Coastal Plain of Fairfax County, Virginia, and vicinity: U.S. Geological Survey Miscellaneous Investigations Series Map (IMAP) I-1423, scale 1:100,000.

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McCartan, Lucy, 1989, Atlantic Coastal Plain sedimentation and basement tectonics southeast of Washington, D.C.: American Geophysical Union, 28th International Geological Congress, field trip guidebook T214, Washington, DC.

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MAP EXPLANATION

Description of Map Units The early Cretaceous Potomac Formation is subdivided into informal members and submembers; each map unit is named for a place in the city where its characteristics are well expressed

Kpsh

Shooters Hill gravel. Medium-coarse, light brown, clayey, feldspathic sand, commonly with abundant granules and pea gravel. Known only from a few small, slumped outcrops and shallow borings between Ivy Hill Cemetery and Shooters Hill, where it forms a thin (<30 ft) erosional remnant beneath the younger river terrace gravel. Physically overlies the Arell clay on a local erosional unconformity. Appears to be the youngest unit in the Potomac Formation exposed in the city

Kpa

Arell clay. Massive lacustrine clay, commonly mottled in green and reddish-brown tones in outcrop. Brownish-gray to blue-gray below the water table. Typically very stiff to hard, with abundant fractures and a high content of expandable lattice clay minerals. Forms steep bluffs and hillsides with many prehistoric and modern landslide scars. Exposed thickness approaches 150 feet, but may be more than 200 feet thick in the subsurface beneath southern Old Town. Typically has a low sand content; lenses of clayey silt are widely present, however. Thin interbedded muddy sands are somewhat more abundant towards edges and near base of unit. Unconformably overlies and truncates all other named units except the Shooters Hill gravel, but may be in a lateral facies relationship to parts of the Chinquapin Hollow fine sandy clay. The Arell clay occupies a bathtub-like basin and is interpreted to have been deposited in a large oxbow lake

Kpch (c, s)

Chinquapin Hollow fine sandy clay. Fine to very fine sandy clay, sandy and clayey silt, organic silt, and clayey fine sand, locally with lignite layers, wood, and leaf impressions. Rarely contains thin layers of fine gravel and granule sands. The main lithologies are closely interbedded in predominantly fining-upwards local sequences at scales ranging from less than one inch to several feet. The contrasting permeabilities of the finely intercalated lithologies typically produce prominent green and brown color banding, or variegation, in most exposures. Expandable lattice clay minerals comprise close to 100% of the clay fraction. Small-scale planar cross beds are present in some sands. Contains scattered, larger bodies of massive silty clay (c) and fine to medium clayey sand (s), which are seldom mappable over any great distance. Unit probably represents a large point bar; minimum thickness is 120 feet. Appears to unconformably overlie Winkler sand, Lincolnia silty clay, and parts of the Cameron Valley sand based on the map pattern, but field relations are obscure, and the unit may grade downward into the tops of large valley-fill sands near the Four Mile Run bedrock valley, or laterally into the Winkler sand

Kpw

Winkler sand. Medium to coarse, yellowish brown, trough crossbedded, arkosic and quartzose sand, locally pebbly. Feldspar in arkose is commonly weathered into clay. Cemented by purple hematite in a few places. Forms a complex of tabular to channel-like bodies in the Lincolnia silty clay, concentrated in a northeast-trending belt centered on Shirley Highway. Thickness typically 30-50 feet but locally exceeds 100 feet near Shirley Highway. Apparently deposited in a northeast-flowing channel system on the Lincolnia floodplain

Kpl / Kpb

Lincolnia silty clay. Massive to slabby-bedded silty clay and clayey silt, moderately sandy in many places. Color typically light green-gray or blue-gray where fresh and red-brown where weathered; commonly mottled near the water table. Clay fraction dominated by expandable lattice types. Small to medium sized lenses and channel-like bodies of fine to medium arkosic sand are common near contacts with the Winkler and Cameron Valley sand members. Thickness typically 50-60 feet, but may exceed 100 feet beneath parts of Lincolnia. Fine, wavy laminations and sandy partings occasionally present in slabby-bedded units. Probably deposited as overbank sediment on a broad, stable floodplain. The Lincolnia silty clay appears to be in a large scale lateral facies relationship with the upper part of the Cameron Valley sand (Kpcv, below). The **Barcroft diamicton** (Kpb) occurs discontinuously at or near the base of the Lincolnia silty clay. It contains pebbles, cobbles, and boulders up to 18 inches long embedded in a dense, massive to crudely layered, red-brown to green-gray clayey to loamy matrix with incipient soil horizonation and organic layers. Clasts include vein quartz, sandstone, and skolithos-bearing quartzites; some are faceted, pitted, and resemble ventifacts. Maximum observed thickness is about 18 feet

Kpcv / Kpcc / Kpcs / Kpcg

Cameron Valley sand. Complex of large-scale channel sands, point bars, and lesser overbank deposits marking inception of Potomac sedimentation. The Cameron Valley sand is divided into four mappable alluvial facies. Lower part of unit (Kpcs) consists chiefly of medium, clayey, arkosic sand and weakly-cemented sandstone that is commonly micaceous close to the bedrock surface. Large-scale trough and planar cross beds are abundant; thin, disrupted silt and clay beds and associated clay clasts are locally prominent. Sequences of gravelly sand (Kpcg) interbedded with thin to moderately thick, light colored silty clay beds are also found in the lower part of the unit. Upper part of unit (Kpcv) is closely associated with the Cameron Run and Four Mile Run bedrock valleys and consists of large, thick bodies of medium to locally coarse, arkosic channel sands interbedded with increasing numbers of silty-clay bodies of various sizes upward in the section. Large, map-scale plugs of silty clay (Kpcc) occur near the base of the unit along Four Mile Run and at several horizons in the upper part. The boundaries between these facies are generalized. Total thickness ranges up to 125 feet at most places, except over parts of the Cameron Run and Four Mile Run bedrock valleys, where it exceeds 200 feet

(Kpa) (Kpch) (Kpcv)

Speculative distribution of **Arell clay (Kpa), Chinkapin Hollow fine sandy clay (Kpch),** and **upper Cameron Valley sand (Kpcv)** beneath Old Town and Del Ray, based on the lithologies reported from the top of the formation in scattered geotechnical borings and old water wells. Sedimentary sequences in the Potomac Formation below this part of the city, and their relations to units mapped in the adjacent uplands, are poorly known because they are hidden beneath thick Pleistocene - Recent alluvium

Kpu

Potomac Formation, undivided. Mapped by Drake and others, 1979, in portions of Arlington and Fairfax Counties

Kps / Kpc

Undifferentiated sand (Kps) and **silty clay** (Kpc) mapped in Clermont Woods Park in Fairfax County

Structure Symbols

Base of Potomac Formation (bedrock surface)

100 — **Isopach**. Line of equal thickness of the Potomac Formation. Contour interval: 100 feet

Contact. Approximately located. Dotted where concealed by water. Highly interpolated where map units are concealed beneath the Old Town terrace

Boundary between the current study area and areas mapped by others

Faults. Dashed where speculative. U/D - upthrown and downthrown sides

U/D — Major (?) reverse fault inferred from abrupt changes in structure, offset of map units, and other geomorphic evidence.

80 D/U — Small reverse fault observed in outcrop during this study. Triangle points in direction of dip. Dip angle in degrees

30 — Small thrust fault observed in outcrop during this study. Teeth on top plate. Dip angle in degrees

31 D/U — Small fault mapped by Drake et al (1979) and Froelich (1985), not found during this study. Arrow points in direction of dip. Dip angle in degrees

4 — **Strike and dip of beds.**

Dominant dip azimuth of cross beds observed in sand and gravel exposures. Length of symbol proportional to general strength: longer symbols indicate exposures with a greater number of cross beds visible

Other Symbols

T Type locality of map unit

R Reference section for map unit

F Fossil location

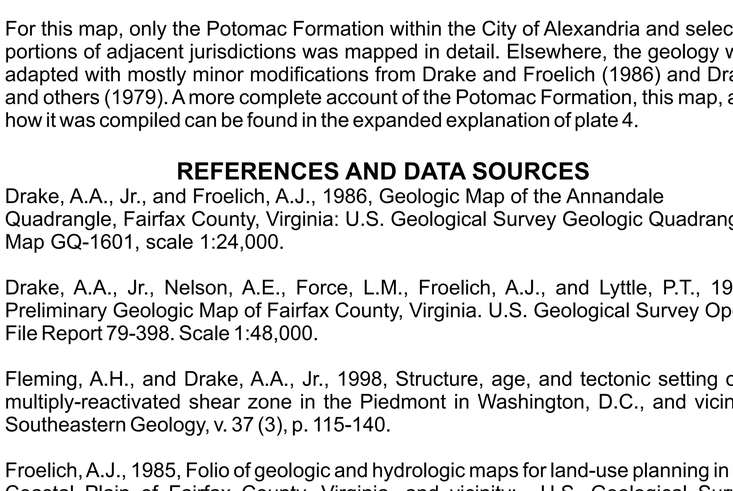

Figure 1. Particle-size distribution of map units

EXPLANATION OF LETTERS:
A - Arell clay (Kpa)
B - Barcroft diamicton (Kpb)
C - Chinquapin Hollow fine sandy clay (Kpch)
Cs -Chinquapin Hollow sand bodies
L - Lincolnia silty clay (Kpl)
S - Cameron Valley sand, lower unit (Kpcs)
V - Cameron Valley sand, upper unit (Kpcv)
W - Winkler sand
X - Silty clay clasts and disrupted beds in the Cameron Valley sand

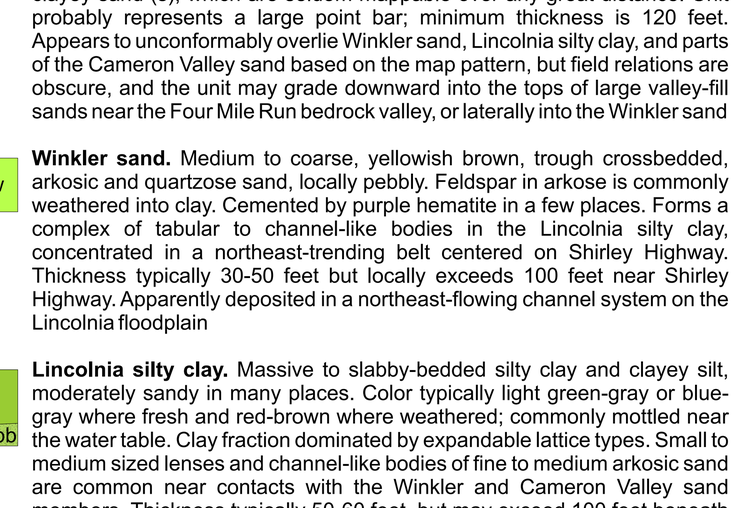

Figure 2. Clay mineralogy of map units

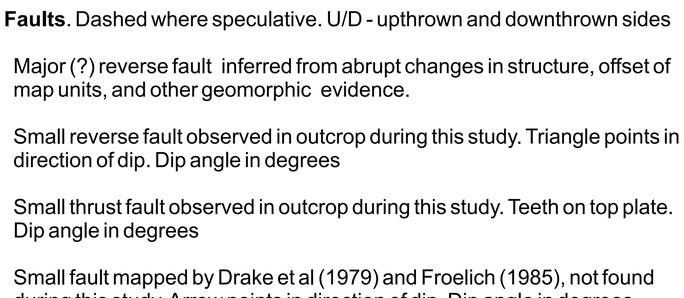

Figure 3. Schematic diagram illustrating relations of map units

GEOLOGIC MAP OF THE POTOMAC FORMATION (EARLY CRETACEOUS) IN THE CITY OF ALEXANDRIA, VIRGINIA AND VICINITY

By Anthony H. Fleming, 2015